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It is not without some difficulty and anxiety that the M. D. of two years standing selects a subject for his M. D. Thesis. The time is so short between his obtaining M. D. and his becoming eligible for M. D. that the young practitioner - if he embrace the first opportunity - can in reality see but comparatively few cases of any one disease.

Several subjects came before my mind for consideration, and for a time I had some difficulty in making a selection. But of late one subject began to press itself upon me more forcibly than any of the others, and that one I have taken up. I chose diphtheria because it appears to me that there are some points in connection with this disease and its treatment that are not quite clearly brought out, and do not occupy a prominent enough position in our standard text books. The chief points

to which I refer are:-(1) There is not sufficient attention given to cases of a mild type with a view to prevent the disease spreading. (2) Neither in our Medical nor Surgical text-books have we anything like a full or detailed account of the after-treatment of tracheotomy. On these points I have dwelt at considerable length, and if in so doing I have been the means of touching a spring whose vibrations may reach the ears of others still more, if I could only hope that through others they may reach the class room then my object in choosing diphtheria would be fulfilled.

It was not without some hesitation that I introduced into this thesis the subject of tracheotomy, with a somewhat prolonged account of its after-treatment, a subject which should, strictly speaking, come within the domain of the Surgeon rather than of the Physician. But I must confess I could not see my way to avoid this difficulty. Tracheotomy is a part of the

treatment of a purely Medical disease, and is an operation the Physician is liable to be called upon to perform, if he wish to offer his patient the chance of recovery afforded thereby. In my description I have been guided entirely by practical experience, especially in the difficulties I encountered in carrying out the after-treatment.

John Hutchinson.

3 Harpur Place,
Bedford,
June 16th, 1879.

Morell Mackenzie defines diphtheria as follows:
"Diphtheria is a specific communicable disease, occurring epidemically, endemically, and solitarily, and characterized by more or less inflammation of the mucous membrane of the pharynx, larynx and air-passages, and by the formation on the surfaces of those parts — especially on the mucous membrane of the fauces and windpipe — of a layer or layers of lymph or false membrane, generally showing signs of bacterioid myeasis. During an epidemic other mucous surfaces exposed to the air, and wounded surfaces of the common integument occasionally, but less frequently, become covered with a layer of lymph, subsequently to, or independently of, a formation of membrane in the more ordinary situations. The disease is generally of an adynamic character, is often associated with a disturbance of the renal function (albuminuria), and is frequently followed by lesions of innervation rarely giving rise to permanent paralysis. The symptoms as regards respiration, vocalization, and deglutition vary with the site of the disease. By far the

larger number of fatal cases terminate by gradual apnoea, but a certain percentage sink from asthenia, blood-poisoning, and cardiac thrombosis".

The term 'specific' is applied to the large groups of diseases known by the name of 'the fevers': by this is meant that although there may be considerable variety, within certain limits, in the types of these diseases, yet they never pass the one into the other. A specific poison is a poison, which, when by some means or other, it has gained access to the system of a healthy person, is capable of producing in that person a disease identical with that during whose course it was formed e.g. Malarious poison never gives rise to typhus, small-pox or scarlatina. — Small-pox produces small-pox and no other disease, Scarlatina, Scarlatina &c.

So also it is believed of diphtheria that it is a specific disease, due to the introduction into the system of diphtheritic poison, and that no other poison will give rise to it.

Diphtheria is now classed among the specific fevers. The propriety of this classification has

has been doubted by some who say that the disease may arise de novo, and that it has no definite period of incubation; but in support of such assertions they can supply no good proof. In diphtheria as in small-pox, or scarlatina, we have (1) History of exposure to infection (2) A pretty definite period of incubation. (3) The febrile stage, although there is often but slight elevation of temperature. (4) Characteristic local lesions. (5) A pretty definite period of duration. (6) Characteristic sequelae. Then like the specific fever it possesses the character of epidemicity and shows predilection for certain ages. All these characters or properties quite justify the classifications that place diphtheria among the specific fevers.

These remarks I have thought it necessary to make as it is of great importance clearly to understand at the outset what is meant by the term 'specific' which will frequently be recurring, and to assign to diphtheria its proper place in the classification of diseases. Of the rest of the definition we shall see more as we go on.

Diphtheria (διφθέρα, a skin or parchment) seems to have been known from the earliest times, but under different names, all of which indicated some throat affection:- Thus terms meaning, Malignant, gangrenous and suffocative sore-throat were applied to the disease.

Bretonneau applied the term diphtherite. Trousseau modified this word to diphtherie, in order to get rid of the termination meaning inflammation. Finally the term diphtheria came to be applied to the disease.

The first accurate account of the disease was published by a French physician in the 16th century, who first definitely mentioned the false membrane. A few years later the same appearances were noted by Spanish physicians, and described under the name of 'garrotillo', one of whom- Villa Real in 1611- describes the false membrane as being elastic when stretched with the hands, and as having properties like wet leather. In 1617 the disease seems to have prevailed as a fatal epidemic in Italy, often carrying away whole families. It was during this

that Severino for the first time clearly described the most characteristic sequela of the disease:- I mean paralysis. We learn from the writings of Cortesius, that the same disease made its appearance in Sicily in 1625. From this time the disease seems to have been lost sight of for nearly a century, when it made its appearance with renewed vigour in various parts of England, Scotland and on the Continent. At length the attention of the profession was fully called to the peculiar characteristics of the disease by J. Home of Edinburgh, who, in 1765, under the name of Croup, described an acute affection of the larynx and trachea, coming on insidiously, attended by the formation of membrane in pharynx and air passages, and often causing death by suffocation

In 1789 we have a report of the disease from America, when Dr. A. Bard publishes an account of an "uncommon and highly dangerous distemper" which had recently proved fatal to many children in New York.

In 1802 Cullen described the disease under the

name of Cynanche trachealis, and it is to this author the credit is due of having first given diphtheria a fixed and recognised place in medical science.

At this time the disease was evidently not very common in this country. But not so in France where it was causing great havoc, and having carried off some of the members of the Imperial family in 1807, a prize was offered by Napoleon I for the best essay on the subject. This drew out several valuable productions, but Bretonneau is the author whose name stands out most prominently at this time. He carefully investigated an epidemic which occurred at Tours in 1818, and published the results of his investigations in 1826.

In 1826 the disease seems to have been epidemic in Edinburgh, although not common in other parts of this country.

Now again it seems to have been almost lost sight of nearly 30 years until 1853, when it broke out with some violence in Paris. In 1855 an epidemic of a malignant type visited Boulogne, and on the following year was believed

to have been imported from France to this Country giving rise to a wide-spread epidemic. In 1858 the disease became very alarming in this Country. Spreading, as it seems to have done, from many separate and independent centres, it raged during the year 1859 as a wide-spread and fatal epidemic. At this time the attention of the profession began to be directed to the disease more than it had hitherto been, and we find several writers of that time treating the subject at considerable esetent.

During the last 20 years there has not been anything like a wide-spread or fatal epidemic of the disease, and little has been written or said on the subject, except occasional accounts, in the medical journals, of outbreaks, chiefly of endemic and sporadic character, until within the last year.

For the last year and a half the disease has been of such frequent occurrence in England and so many children have been carried off by it that it is now a subject of public interest and many medical societies and medical men

generally, in various parts of the country, are setting themselves to work with all their might to investigate its nature and cause, in the hope that happily they may make discoveries, which may stay, or at least lessen the ravages of such a terrible disease. A new impetus has of late been given to these investigations, by the disease having, within the last few months, attacked the Grand Ducal family of Hesse-Darmstadt and by its having taken away the Grand Duchess.

The foregoing is a very short and imperfect outline of the history of diphtheria; but as a clinical report in a medical ward would be very imperfect and unsatisfactory, if it did not carry with it something of the onset and progress of the disease under investigation; so I think an essay on a medical disease must likewise be imperfect and lose much of its interest if it does not contain a short account of the history of that disease

Diphtheria seems to be a disease of all seasons and of all climates. It occurs alike in hot and in cold weather, in summer and in winter; in

have it in the tropics, in the north and south of Europe, in America and in Australia. It attacks people of all ages, but especially young people, and by far most frequently children between the ages of two and six years. It is a disease of all ranks and degrees of men, having no respect for social position but being found equally in the palaces of the wealthy and in dwellings of the beggar.

It seems to have a preference for country districts rather than cities.

We are not, according to our present state of information, clearly able to associate its occurrence with sanitary defects.

Etiology. The predisposing causes seem to be age, and family peculiarity or susceptibility.

From the Registrar-Generals returns we learn that in every 1,000 fatal cases, between 400 and 500, or nearly one half are from 1 to 5 years old; while only 25 per 1000 are 45 years of age and upwards.

Of the second predisposing cause it appears that people with tender or 'relaxed' throats, those

subject to chronic or catarrhal inflammation of the throat, are peculiarly liable to contract the disease. Of this I cannot give a more striking example than the late outbreak ~~in~~ of the disease in the Grand Ducal family at Hesse-Darmstadt.

From the British Medical Journal of Jany 4th 1879, we learn that the medical officers who attended the family, afterwards giving a report of the outbreak, put down as one cause of the intensity and extension of the family epidemic "the condition of the mucous membrane of the pharynx and of the tonsils of the infected persons, all of them having suffered frequently from acute and chronic affections of these parts"

The Grand Duchess, however, very seldom suffered from sore throat, and it is rather remarkable that she, who was naturally most exposed to infection, was last in catching the disease.

Here we have an example of the disease, not in a mild form, but as Prof. Gerhardt puts it "in the worst form it can take", entering a family of seven and spreading over all its members except

two; yet not a single nurse, servent, nor any other person brought into immediate contact with the patients, who did not belong to the family, in all this large household (60 persons) suffered from the disease, although exactly similarly situated.

In my own experience I have met with a similar example where diphtheria entered a family of five children, attacked four, and cut off three of them. Outside this family not another case of diphtheria was known to have occurred in the village for several months before or after.

Pages might be filled with similar illustrations, but these two examples will perhaps suffice to show, that family susceptibility cannot but be regarded as a predisposing cause to a very marked degree.

Sex, season, climate, and social position seem to have very little - if indeed they have any - influence as predisposing causes.

Dr. Greenhow says:- "Station of life and the enjoyment of affluence, or the exposure to the privations of poverty, seem to have but small

influence, either in predisposing persons to take or to suffer severely from the disease".

Persons who have once suffered from diphtheria, no doubt enjoy a certain amount of protection from a return of the disease, just as in the case of the other specific fevers. But numerous cases of secondary attacks of the disease are on record. Morell Mackenzie tells us that he has known three instances in which the children have died from the second attack, which occurred at periods of 7, 12 and 13 months respectively after the first attack.

Exciting Cause. This is a specific poison or contagium. It is true that cases do occasionally crop up which seem to be difficult to account for in any other way than that they originate de novo; but it will be found in almost every instance, if sufficient trouble be taken to investigate the case thoroughly, that these cases have derived the germs of the disease from previously existing cases,

which may have been so mild as to have been overlooked, or which may have existed so long previously as to have been forgotten, but leaving behind, in a suitable place for its preservation, the subtle poison, which, when somehow or other it has gained access to a suitable soil gives rise to a fresh outbreak of the disease.

Now, a Contagium is an agent developed in and given off from the body of the sick, which, when received into a healthy susceptible body, is capable of producing in that body a disease similar to that during whose course it was formed.

For the production of disease some poisons require direct implantation – eg. the poison of Syphilis and of hydrophobia; while others seem to be given off in the exhalations from the lungs and skin, and to gain access to the system through the breath, food or drink. The former never become epidemic, the latter do and it is to this class that diphtheria belongs.

What is the nature of the contagium of diphtheria?

This is a question which cannot yet be regarded as quite settled. But the frequency with which minute granules are found associated with the local lesion, and in the blood of affected persons, renders it highly probable that these granules are the poisonous agent. These granules, which, on closer examination are found to be micrococci, are found infiltrating the affected tissues at all stages of the disease.

Nassiloff regards the changes which constitute the diphtheritic lesion as probably due to the occupation of the channels of absorption by masses of micrococci.

Eberth thinks that without micrococci there can be no diphtheria.

Oertel says there can be no doubt that these organisms are not of accidental occurrence.

Some observers have been inclined to think that these organisms are a result and not the cause of the local lesion; but this is now an exploded view of the

pathology of diphtheria.

The poison then, I believe, very probably consists of minute organized particles, capable of floating in the atmosphere, which, when they gain access to the system, find a suitable niche in the mucous membranes and sub-mucous tissues, and that by far most frequently in the throat, mouth or air passages. These germs are of such a kind that they retain their vitality for a long time external to the body, and only develop when they find a suitable soil, which may be at the end of weeks, months, or even years if the poison have found a suitable soil for its preservation.

How does the poison enter the system? This may be (1) By direct implantation or inoculation (2) Through food or drink. (3) It may be carried in by the breath. It appears that it is extremely difficult to communicate the disease by inoculation, either to man or the lower animals. Numerous experiments of this kind have been tried by medical men on themselves and on the

lower animals, but the results have only been negative; there being caused only a local inflammation around the seat of inoculation. It would appear however that direct application of the contagium to the mucous membrane where it finds its suitable nidus, is capable of giving rise to the constitutional disease. Thus in experiments made upon rabbits, a diphtheritic membrane was found in the trachea as the result of direct irritation of that part with diphtheritic matter, and the animals died on the second or third day with symptoms of general affection.

Doubtless both food and drink act as vehicles, but in all probability the latter much more frequently than the former seeing that water is so apt to be contaminated with excrementitious matter.

But the disease germs whether they be carried off by the breath, or escape from the exhalations of the skin, or whether they emanate from sewerage, may be received into the healthy organism through the breath, and get absorbed through

the mucous membrane of the throat, trachea, or lungs. We know from a therapeutic point of view that medicines given by inhalation act very rapidly and very decidedly. May we not fairly conclude that so also does diphtheritic poison, when we hear of a medical man, who, while examining a diphtheritic throat accidentally inhales the contagium and in less than 48 hours dies of diphtheria?.

Let us now see how the poison acts after entering the system.

Having entered the system the poison - except in very exceptional cases - remains in an apparently dormant condition for some time. This is what is called the period of Latency or Incubation. By the period of incubation is meant the time which elapses between the entrance of the poison into the system and the appearance of the first symptoms of the disease. During this period, however, the poison is not dormant, as it appears to be, but active.

We have seen that the poison, is, in all probability particulate and organic. Now, suppose one of these organized particles to have entered the circulation and to have found the conditions necessary to its growth and development; it at once begins to grow and reproduce its kind. Now, these organisms derive their food from the fluids which go to nourish the various organs and tissues of the body. At first, however, the germs being but few in number require but a small amount of pabulum, and with this the system is able to part without much inconvenience; but as the development and propagation of these organisms go on a point is at last reached when the system can no longer tolerate their action. At this point the period of incubation ends and the stage of Invasion commences, which makes itself known by certain manifestations of constitutional disturbance.

This period of incubation in diphtheria, as in the other fevers is of variable duration.

Most observers are inclined to regard it as from three to twelve days; but it may be less or more. In most cases the disease makes its appearance on the fourth or fifth day after exposure to the contagium.

Morell Mackenzie, in his monograph on diphtheria relates the following very remarkable case.

"A little girl, aged six years, who had been absent from home for five weeks, returned one afternoon at four o'clock. Her young brother aged four years had shown symptoms of sore-throat the same morning, but no suspicion was entertained that the disease was diphtheritic. These two children remained together till bed-time, but did not sleep in the same room. Next morning both of them had marked diphtheria with abundance of false membrane. The girl had not been subjected to any infection before reaching home."

Sometimes the first indication of the invasion is given by the presence of false membrane; or it may be that glandular swellings or discharge from the nose first attract attention.

Pathology The most apparent lesion is an inflammation of one or more, but usually several, of the following parts viz:, velum palati, fauces & tonsils, pharynx, larynx, trachea, or nasal cavity, leading to an exudation and the formation of a false membrane on the surface of these parts. We shall afterwards see that under certain circumstances false membranes may also form in other parts.

The exudation may be white but it is more frequently ash-coloured in appearance; it is tough and elastic, but when drawn out it does not separate into threads but gives way and is torn across. It is firmly adherent and if we separate a portion of it we find that the mucous membrane beneath is left eroded and bleeding, if left alone, however, the false membrane separates of its own accord in a few days, leaving behind a raw and denuded, or slightly ulcerated surface; the latter appearance is perhaps frequently caused by the accumulation of pus cell beneath the membrane before it was shed.

On microscopic examination we find that this

false membrane is not fibrinous, as one would be led to infer, if guided by naked eye characters above, but altogether cellular. It consists of degenerated cells fused together, which, towards the surface of the mucous membrane are small in size, but at the extreme periphery of the false membrane they are of considerable dimension. Rindfleisch says that this gradual transition proves most undeniably, that the false membrane is produced by the secretion of young elements, upon the irritated mucous surface, followed by their gradual stiffening, sclerosis, glassy swelling, or whatever term we may choose to apply to their degeneration. In the early stage of the disease the affected mucous membranes are red and very hyperæmic, and the mucous and sub-mucous tissues are infiltrated with inflammatory products. This infiltration is sometimes so considerable that that the bloodvessels are so much pressed upon as to arrest the circulation and gangrene ensues. Then we have the parasitic phenomena which have already been mentioned, but a few words

may here be added on this subject.
Dr. Maclagan in his book on the Germ
Theory of Disease says: The association of the
lesion and the organisms is constant," and
that the extent of the local lesion and the
severity of the general symptoms, are directly
as the reproduction of the organisms. That
is to say, the more organisms reproduced the
severer the attack, and vice versâ.
Hitherto the combined efforts of the biologist,
the chemist and the microscopist have been
unable to discover the exact nature and mode
of action of these organisms. We know that the
poison once introduced into the blood exer-
cises on that fluid a pernicious influence,
rendering it unable to perform the function
for which it is destined by nature viz, the
nourishment of the various organs and tissues
of the body; and we know that a train of
symptoms follows, which collectively are known
by the name of 'fever': but how these changes are
brought about and what gives rise to the
symptoms we can, in a great measure, only surmise.

Are we to regard them as the result of starvation, or the result of toxaemic agents? Or are we to regard them as the result of both these combined? I think they must be regarded as the result of both combined.

The depraved blood supplied to the brain is unable to afford it proper nourishment, consequently there is impaired nutrition of that organ, and inevitably impairment of that nervous influence which is requisite to the due performance of their functions by all the organs and tissues of the body. A similar deterioration of the blood supplied to the digestive organs, leads to imperfect performance by them of their several functions. But the nerve influence of these organs is already impaired, and therefore we have the combination of these causes to account for loss of appetite, very imperfect digestion, and defective assimilation which go on during the course of the disease. Then we must keep in mind that we have the contagium particles, in all probability, devouring the most nutritious

part of the little nourishment which enters the circulation.

But the same causes may combine to render the organs of execretion unable to perform their function in a proper manner, leading to the retention in the system of waste products which should otherwise be eliminated. Now it is highly probable that these retained effete products execreise a toxaemic influence on the brain which may account for some of the phenomena of fever.

The lungs may present various appearances depending on the mode of death and complications. There is usually more or less inflammation of the bronchial tubes; and the false membrane may extend down to the third or fourth division of the bronchi. It is common to find a certain amount of engorgement and oedema, especially at the base of the lung. Or we may find pneumonia; or individual lobules may be collapsed from blocking up of the smaller bronchi by plugs of mucus.

The Parotid, sub-maxillary, and cervical

lymphatic glands are usually enlarged and the seat of pathological changes. The cells of the acini are generally either swollen and filled with a homogeneous mucoid material, or replaced by quantities of small round cells. I have lately been informed by a friend that in a case of diphtheria under his charge one of the mammary glands enlarged to the size of a goose's egg; the enlargement had almost disappeared when the patient – a boy of 10 – died a few days afterwards.

Various changes may be found in the heart. Its muscular tissue frequently shows signs of fatty degeneration. Its cavities may contain fluid tarry blood or coagula. Frequently it gives evidence that it has been the seat of endocarditis. Cardiac thrombosis is looked upon as one cause of sudden and fatal termination.

In nearly one half the fatal cases, in which the bodies have been examined, the kidneys have been found to present marked changes. They are generally swollen and congested; and

under the microscope the epithelial cells lining the tubules are found to be swollen and granular, and they have often undergone extensive proliferation; the crowded masses of young cells forming casts of the tubes

The changes found in the brain are not, as a rule, well marked and depend on the mode of death to a great extent. But in a case of diphtheritic paralysis, Charcot found that the motor nerves of the affected part consisted of tubules emptied of their medullary substance, and their neurilemma contained numerous granular cells.

Symptoms. Having considered the nature of the poison, how it may enter the system, and indicated to some extent the ways in which it may probably act; we now come to consider the symptoms which result from the action of the poison on the system.

Some time - usually from two to four days - after exposure to diphtheritic infection, the patient begins to feel indisposed and unable

for his daily avocations; soon loss of appetite and slight feverishness come on, and there may or there may not be, either at this stage or later in the course of the disease, sickness, vomiting, pain in the back and severe headache. Soon a feeling of itching and sensation of dryness and uneasiness in the throat are complained of, and these gradually increasing in severity, are in a short time replaced by painful and difficult deglutition. Loss of appetite becomes a more and more marked feature of the disease, and the temperature continues to go up until it reaches perhaps 104° F. By this time there is usually to a more or less degree, a swollen and painful condition of the parotid and sub-maxillary glands, with some enlargement of the cervical lymphatic glands, giving an appearance of fulness in these regions with tenderness on pressure. The pulse is weak, rapid and very compressible. There may also be at this stage a nasty, watery, irritating discharge from the nose. If we now examine the mouth and throat we may find the tongue comparatively moist and covered with a white

semi-fluid coating, or it may be dry and covered - the whole or in part - with a yellowish or brown fur. The soft palate, fauces, and back of the pharynx, will usually be found inflamed and bright red in colour: there may or may not be enlargement of one or both tonsils. The characteristic exudation may by this time have made its appearance, or the formation of one or more patches of false membrane may already be seen on the tonsils, pillars of the fauces, back of the pharynx, or on the uvula or soft palate. The exudation generally makes its appearance as several separate and distinct spots on one or more of the above mentioned inflamed parts - most frequently on the tonsils - which coalesce as the disease advances. As the disease progresses the symptoms become aggravated; the glenolular enlargements have increased and the neck is now swollen, stiff, and painful; the pulse remains small and rapid; and probably by this time prostration and pallor, which are such marked features of the disease, have begun to make their appearance.

Loss of appetite has increased and the swelling and inflammation of the throat have increased to such an esetent that the act of swallowing is accomplished with difficulty. The diphtheritic patches may now have coalesced in such a way as to form one or more larger patches, or to form a continuous coating of false membrane over the soft palate, uvula, fauces, pharynx and larynx; or it may have esetended to the trachea giving rise to Croup; or to the nasal cavities, as indicated by a peculiar tone of voice and by a constant discharge from the nose. If at this stage we esecmine the urine we may find that it contains albumen, and it may be tube-casts and a few blood cells.

From this point the disease may take a favourable or an unfavourable course.

If the former, the patient soon begins to show signs of improvement; the false membrane begins to fall off, and now if the exudation was esetensive, the breath frequently acquires a very offensive odour - supposed to be due to decomposition of the false membrane. The pulse

falls; swelling, pain, and stiffness of the neck disappear; as also do the tumefaction and sensation of discomfort experienced in the throat; deglutition becomes less difficult; the appetite increases; the functions of the skin are restored; so that in a comparatively short time – perhaps from ten days to a fortnight from the first appearance of the disease – the patient is convalescent; or it may be that he feels well but for the debility and anaemia left behind.

The above description may be regarded as that of a somewhat typical case running its course to a favourable termination. But the disease may be of such a mild form as not to require the patient to remain in bed, or in very mild cases, not even to discontinue his business. On the other hand, it may be of such a malignant type as to fell the patient in a few hours, and in two or three days a fatal termination has been reached.

In children the subjective symptoms are often to a great extent lost, so that we have

to depend almost exclusively, to the objective symptoms to guide us; but these, alas! are often only too well marked.

Instead of such a favourable termination, however, the disease may go on increasing in severity until the patient sinks from blood-poisoning, coma, or asthenia. Or the disease may attack the larynx and trachea, causing mechanical obstruction of the air-passages, and death from asphyxia is the result. When death is brought about in this way we have, however, three causes operating viz., the formation of false membrane, and inflammatory thickening of the mucous and sub-mucous tissues of the larynx and trachea combining to diminish the calibre of the air passage; then superadded to these we have reflex, spasmodic, muscular action which closes the glottis, but at the same time also assists in diminishing the size of the windpipe.

When the false membrane forms in the larynx or trachea, or in both, the disease is called Croup and is said to be one of the most

fatal diseases to which humanity is liable."
This form of the disease seldom attacks adults.
It is for the most part marked by unmistakable signs, these being, cough, hoarseness, difficulty of breathing and evidences of imperfect aëration of the blood

Cough is usually the first symptom to attract attention, and for a time the most prominent one; it is short, dry, and paroxysmal in character. Next to the cough slight hoarseness of the voice is observed; but soon there supervenes difficulty of breathing, and this often appears for the first time during the night. All these symptoms rapidly increase in severity; respiration becomes noisy and stridulous; the voice gets hoarse or is lost altogether; the cough becomes hard and metallic in character; during the paroxysms, which have now become much more severe and more frequent, the child shows evidences of extreme distress; it sits up, clutches at anything it may get a catch of, or pulls at the throat, tosses itself about, throws back its head, opens its mouth, dilates its nostrils, and

struggles for breath. The general surface of the body - especially the face - becomes livid, the eyes staring, and the expression me of intense anxiety. After a paroxysm of this kind there is an interval of comparatively calm and quiet breathing. But the returning paroxysms gradually increase in frequency and severity until at length the little patient, quite overcome with exertion and gradually increasing asphyxia, dies in a state of combined coma and prostration.

Laryngeal or tracheal diphtheria does not always terminate in such a manner. The false membrane may become detached and may be coughed up, or the trachea may be opened. In either case there may be immediate relief to the breathing and recovery may ensue although the case was apparently quite hopeless.

But the disease may not have assumed such a severe character as either of those we have already considered; it may be of the mild Type, which, of all others does most mischief, as its presence is very often not detected

and it scatters its seeds far and wide, and so is productive of much evil.

In this type the symptoms are often so slight that the practitioner has much difficulty in diagnosing the true nature of the disease, he being unwilling to attribute them to a disease, the very name of which is heard with consternation by all parents. In fact the symptoms are very much the same as those due to Catarrhal sore-throat.——

The child feels 'out of sorts' and slight languor supervenes; it becomes slightly feverish the temperature being perhaps one or two degrees above the normal, the pulse rate is increased in proportion to the change of temperature; there is usually some swelling of glands about the angles of the jaw; and there is not unfrequently a watery discharge from the nose. Slight soreness and dryness of the throat with some difficulty of swallowing will probably be complained of, and there may be headache or pain in other parts of the body. If we now examine the throat,

we will probably find the soft palate, the tonsils and back of the pharynx of a bright red colour and somewhat swollen. In some cases only one tonsil will be swollen the other being normal in appearance; or the inflammation may be slight and limited in extent. The tongue at this stage is usually moist and slightly coated and in many cases no exudation can yet be seen. But in a short time numerous whitish or yellowish spots begin to make their appearance on one or other or both tonsils, back of the pharynx and soft palate; these are often small in size and at first may easily be removed; they may remain of small size and separate or they may coalesce to form one or more large patches. From this time the patient gradually recovers and in three or four days may be convalescent; there is usually, however, left behind a considerable amount of anaemia and prostration, and the patient feels weak for several days or it may be for weeks. Associated with the above symptoms there

may have been some albuminuria, but the true character of the disease or affection, is often only revealed by the subsequent occurrence of paralysis.

But the type may be still milder than this one & there may be no enunciation visible or any point from first to last.

Other types of diphtheria, than those we have noticed have been met with and described e.g. Malignant and Gangrenous diphtheria, but of these I have no acquaintance and fortunately they are of rare occurrence in this country.

Some of the symptoms of diphtheria require a more detailed account than has been given to them above. But before passing on to it, I have thought that this might be a suitable place to introduce short notes of a few cases, which may conveniently be made use of to illustrate the more important features of the disease; i.e. its prominent symptoms, modes of death, and some post mortem appearances. The first three cases came under my care

while acting as resident assistent in the Western Infirmary, Glasgow; the others since I came to Bedford at Christmas last, where the disease has been more or less epidemic during the last year and a half.

Case I. E. M. aged 1 year and 8 months, was admitted to the Western Infirmary on Feb. 11th 1878, about 7 P. M., on account of severe paroxysmal cough and difficulty of breathing. The patient proved a healthy well nourished child. Her parents said that about a week before admission the child began to be troubled with a short, dry cough which soon got worse and in a few days shortness of breath and difficulty of breathing began, which caused them some alarm and led them to seek medical aid for the child. The medical attendant, after watching the progress of the case for some time, and seeing that his treatment was having no good effect, but that the case was going on from bad to worse - life at this time being threatened by asphyxia - sent the

patient to the Western Infirmary to have tracheotomy performed immediately.

On admission the child showed signs of great distress; the paroxysms recurred frequently; the cough was metallic in character; the voice hoarse; respiration was performed with great difficulty, and inspiration was crowing or stridulous in character. The face was slightly swollen and livid; the pulse small and frequent; and the skin rather cold. The throat was inflamed, but no distinctly diphtheritic exudation or patch could be seen in any part; nor were the glands swollen externally.

Tracheotomy was at once performed ~~with~~ with instant relief. Immediately after the operation some pieces of false membrane were brought up into the mouth. At various times while the tube was worn bloody mucus, and milk or other fluids taken as drink were expelled through it; otherwise the case progressed most satisfactorily and there was never a bad symptom; the child

being dismissed perfectly well on March 13th.
No albuminuria.

Case II J. N., aged 1 year and 10 months, was admitted to the Western Infirmary on the 28th March, 1878, at 8 P. M. Six days before admission patient began to be troubled with a cough, which gradually increased in severity and came on in paroxysms; soon shortness of breath and difficult and noisy breathing supervened. The child was now shown to a medical man, who, after having the child under his care for three days, and seeing that he was getting worse in spite of all his efforts, sent him to the hospital to have tracheotomy performed as the only hope of saving life.

On admission the patient seemed in a very dangerous condition. He was frequently seized with severe paroxysms of cough and dyspnœa the face, with the surface of the body generally was livid; the superficial veins of the face

and neck enlarged and prominent, the face was swollen, and large drops of perspiration stood on the forehead. Respirations were very frequent and the alae nasi moved freely at every effort; he had great difficulty in breathing; Cough was metallic in character, and the inspiratory efforts were accompanied by a crowing noise. Pulse was very rapid and very small. A greyish, semi-fluid coating was to be seen on the back of the tongue and on the tonsils, which could easily be wiped off leaving the mucous membrane beneath quite unaffected.

Tracheotomy was at once performed, and after the operation the breathing became quiet, the colour improved, and the congested veins seemed relieved.

From this time the case progressed most satisfactorily and was dismissed well on the 22nd

This patient was a very small child of his age, had a clear skin with blue veins shining through, had fair hair; was bow-legged; could walk a little but was unable to speak. There were

glandular enlargements about the angles of the jaw and in the neck, but these seem to have existed for some time before his illness came on and did so after his recovery.

Urine was free from albumen.

In this case also, bloody mucus was occasionally expelled through the tracheotomy tube.

Case III. W. C. a boy aged 6 years, was admitted to the Western Infirmary on Apr. 16th 78. I regret that I was unable to get a detailed account of the onset and progress of this case, not having seen either the medical attendant or the parents of the child. But from a neighbour who took the child to the hospital I learnt, that he had for a week previously complained of sore-throat, cough, shortness of breath, and difficulty of breathing; but that on the night before admission he suddenly became very ill and the breathing became suffocative.

When admitted he appeared as if he had only a few minutes to live. He lay quite

motionless (except those of respiration) in the nurses arms, and did not give the slightest attention to, or take the slightest notice of what was said to him or what was going on around him; the eyes were half closed; the face swollen and congested; the surface of the body cold and livid, the lividity being especially marked in the face and lips which were dark blue in colour; respirations were from 10 to 12 per minute, and the inspiratory efforts were deep and gasping; a trace of the pulse could be felt but so exctremely weak that it was utterly impossible to count it. On examining the mouth and throat, the tongue was found to be dry and furred, while a firmly adherent yellowish membrane covered the surface of the velum palati, fauces, and back of the pharynx

The trachea was at once opened and a tube introduced to breath through, & immediately afterwards respirations began to increase in in frequency, and in a short time the breathing became quite quiet and natural; lividity be-

gum to disappear and soon pink spots could be seen on the cheeks, which rapidly increased in size, and in less than an hour the skin had re-gained its natural colour, and the surface of the body had become warm. By this time the child had become quite conscious, could recognise a friend who stood by, would ask for a drink or answer questions by making certain signs. (by signs because the presence of the tube totally covers the voice altogether).

From this time, with the exception of sickness and restlessness, as indicated by vomiting of his food, throwing about of his arms and legs &c, the child seemed to go on favourably for 24 hours, when, all of a sudden after an attack of vomiting, he died, apparently from asthenia.

From the time of the operation the breathing remained perfectly quiet and free from obstruction of every kind.

Glandular enlargements were very marked in this case.

Post mortem (Dr Coats)

"Tongue soft palate &c removed. A consistent membranous exudation covers the soft palate, tonsils, pharynx, surface of epiglottis and mucous membrane of larynx, the latter to such an esetent as to fill up the larynx. In the pharynx and soft palate the false membrane is partially adherent and the mucous membrane beneath is very red and eroded. In the trachea the mucous membrane is covered with a half fluid exudation, which is continued into the bronchi, where however it takes the character of pus."

Case IV. On Dec 29th, 1878 I was asked to see R. H. a healthy looking well-nourished boy of 10 years of age. His mother informed me that he had been "not quite well" for two days previously; he had had chills, headache, loss of appetite, and he complained of soreness of the throat and some difficulty of swallowing. When I first saw him the skin was hot and

dry; pulse 112, but of fair strength; there was very distinct enlargement of the parotid and sub-maxillary glands; and a watery irritating discharge kept constantly flowing from the nose. The tongue was tolerably moist and only slightly covered with a whitish, viscid coating at the back. The velum palati, fauces and back of the pharynx were bright red and turnefied, and the right tonsil, slightly but distinctly enlarged. But no appearance of diphtheritic patches could be seen on any part, the coating on the tongue being easily displaced and it was then seen that the mucous membrane beneath was quite free from erosion

The slight constitutional disturbance, the glandular enlargements, and the discharge from the nose made me strongly suspect that this was a case of genuine diphtheria and on this ground I ordered the patient to be separated from all the other children in the family. &c.

My governor saw the child on the evening of the same day, but he was rather inclined to look upon the case not as one of diphtheria, but,

simply as catarrhal sore-throat. Next day however, to my satisfaction all doubts as to the nature of the case were removed by a characteristic diphtheritic patch having made its appearance on the right tonsil
The patient was convalescent in about ten days, and although there were other children in the house, yet the disease spread no further.

Case V "E. G. aged 10, a tall, fragile delicate girl, a younger member of a large family, was attacked with "sore throat" on Jany 5th 1879. The house is large and spacious, and its sanitary condition had been subjected to enquiry and was believed to be perfect. This enquiry arose from an attack of diphtheria, which had affected her younger brother, aged 8, in Oct. 1876. The brothers illness had been marked by esetreme and long continued prostration, and the most marked objective sequela, was strabismus which continued for some weeks, the 3rd nerve on both sides being affected with partial paralysis. When I first saw E. G. she was in high fever,

temperature 103°, pulse 130, there was no visible
exudation, but by candle light the palate and
fauces were seen to be of bright scarlet colour,
and there was some infiltration of the cellular
tissue of the neck. The next day the exudation
had appeared, and spread all over the visible
surface of the velum palati and tonsils.
The special peculiarity of the case was that the
inflammatory process invaded the nasal cavity
to the great distress of the patient; she often
expressed far more suffering from the nose than
from the throat. She had one or two attacks of
epistaxis, but there was a constant discharge
of thin, acrid fluid in such quantities as to
render the use of pledgets of cotton wool, for
its absorption and removal, constantly necessary.
This fluid excoriated the skin about the nasal
orifice and upper lip, and continued for a
fortnight. She ultimately recovered slowly
but remained very weak until removed to the
country in April. There was slight and temp-
orary strabismus, in this case also during con-
valescence."

The notes of the last case were supplied to me through the kindness of Dr. Goldsmith; but the case was one of such interest that I frequently visited it with him. I may add that I carefully tested the urine and found it free from albumen.

Case VI Here there were two children, 12 & 5 y. whose respective ages were 8 & 6 years, affected in the same family; but as they sickened at the same time, and as their symptoms in both cases throughout the course of the attack, were as nearly as possible identical, I have placed both under case VI

I first saw these children on Feb. 14th 1879, being summoned by a note from their mother who, therein stated that her children had got diphtheria. On my arrival I found both children in bed. Both had taken ill two days previously, being affected with chills, loss of appetite, and general languor. There was neither glandular enlargement nor discharge from the nose, at this or any other time throughout

the course of the disease. When first seen the skin was hot and dry, but the increase in temperature was not great, nor was the pulse rate much increased in frequency. The tongues were moist and clean; the mucous membrane of the soft palate, fauces and back of the pharynx, bright red, and the tonsils slightly enlarged. In the case of the elder child - a boy - there was a white, firmly adherent patch of false membrane, about the size of a fourpenny-piece, on the left tonsil, and several small white spots scattered over the right tonsil and back of the pharynx. In the case of the younger child only a small white firmly adherent patch was to be seen on the right tonsil

Both these children were convalescent in six or eight days afterwards, but considerable debility and anaemia existed for several weeks afterwards.

Case VII On Feb. 17th, 1879, I was called to the same village to see J. S. a girl aged 15 years,

who, on the previous day had been seized with chilliness, head-ache and general langnor, there was also occasional vomiting after food. When first seen there was just a perceptible amount of enlargement of the glands at the angles of the jaw, but no coryza. The temperature was not apparently altered, and the pulse only slightly increased in frequency. A sense of discomfort in the throat was complained of, but there was hardly any difficulty in swallowing. The tongue was moist and clean, but there was an inflamed condition of the mucous membrane of the velum palati, fauces and pharynx, with enlargement of the right tonsil, over the surface of which were scattered several separate and distinct, slightly elevated, adherent, white patches, each being about the size of a hemp-seed.

Case VIII Three days after seeing J. S. I was summoned to the same village to see her cousin a boy of two years of age. This child I had previously attended on account of

catarrhal affection of the throat. His mother informed me that he had sickened on the previous day and that he had passed a sleepless and rather restless night. When I saw him, the child was feverish, irritable, and restless; pulse 120; the glands about the angles of the jaw were enlarged, and there was a slight watery discharge from the nose. There was a short, troublesome cough, but altogether without the metallic tone so characteristic of Croup; the tongue dry and coated with a brown fur; the tissues of the throat and palate inflamed, and the tonsils enlarged. But no false membrane was visible in any part. I was unable to pronounce this a case of diphtheria because (1) There was no false membrane to be seen. (2) The child was subject to tonsillitis and glandular enlargement about the neck. (3) The discharge from the nose was slight, and the voice was not nasal nor was the cough Croupy in character.

Next day however the most important symptom of diphtheria had come to our aid

— there was a small patch of false membrane on one of the tonsils.

All these children made a good recovery.

It is to be observed that these families held frequent intercourse with each other; and they were the only persons in a large village affected with the disease

Case IX On March 7th 1879, I saw for the first time A. B. a boy aged 6 years, residing in the outskirts of Bedford, and convenient to where I saw R. H., on Dec. 24th. He had been unable to attend school on the previous day and during the evening had chills with loss of appetite and sickness. When first seen there was slight feverishness with increase in the pulse rate (110). The parotid and sub-maxillary glands were considerably enlarged and slightly tender on pressure; and there was a nasty ichorous discharge from the nose, causing excoriation of its angles. The tissues of the throat were inflamed and very red; the tonsils enlarged, and over the right were scattered

several distinct slightly elevated, firmly adherent, white patches varying in size from a hemp seed to that of a split pea.

This I had no hesitation in regarding as a case of genuine diphtheria.

Three days afterwards the sister of A. B. aged 4 years, was taken with almost similar symptoms, except that there was no nasal discharge, and no false membrane was seen from first to last. This child was confined to bed for a week, and from the anaemia and very marked prostration which followed I was inclined to regard it too as a case of genuine diphtheria.

A. B. was convalescent in a week and made a good recovery.

The notes of the next case I received from Dr Goldsmith; they serve well to illustrate one peculiarity of the disease viz., sudden death at a time when the patient might be regarded as out of danger

Case X "M. I aged 10, a delicate looking but other-

wise healthy boy, was seen on March 9th. The false membrane was already fully developed on right tonsil, but no alarm had been excited and he was not in bed when first seen. He promised most favourably for some days; the membrane, which spread over the other tonsil and velum palati, had at the end of a week almost entirely disappeared. He took food well but manifested signs of profound disturbance of the assimilative powers. The bowels never acted fairly and small doses of castor oil (3i) were given, the action of a more powerful aperient being feared on account of the too evident tendency to collapse. Large enemata were tried in vain, and on the 18th the rectum being found loaded with faeces, they were removed mechanically. Although bright and cheerful in the morning, the signs of approaching dissolution were evident. The hands and feet became blue and cold; the pulse very quick (140) and weak; the stomach rejected all stimulants which were freely administered; and he sank in the evening (18th) retaining consciousness until the

last"

I carefully examined the urine in this case also but failed to detect albumen in it.

Case XI W. B. aged 5, sickened on Sunday Apr. 27th 1879. and became an in-patient of Bedford General Infirmary on May 2nd – five days after the invasion of the disease –, On the evening of admission the temperature was 102°, Pulse 130 and very weak; and the child was languid and pale. There was a degree of fulness about the angles of the jaw, but no distinct glandular enlargement existed either then or at any subsequent period in the course of the disease. The tongue was dry and coated with a brown fur; the soft Palate, tonsils and back of the pharynx, were covered by a firmly adherent false membrane of a yellowish colour. The voice was slightly nasal in tone but there was no croup. ~~The voice was slightly nasal in tone,~~ and during sleep breathing became noisy as if respiration was carried on, in a great measure, through the mouth. Urine loaded with albumen.

May 4th Temperature 99; no membranous exudation to be seen except a patch on the right tonsil; mucous membrane of velum palati, fauces and pharynx raw and eroded; pulse still rapid and weak.

May 7th Only a small patch of exudation can be seen and that on the left tonsil; mucous membrane of soft palate very much abraded; pulse very weak and 70 per minute

May 10th This morning the child looks very anaemic, but is more cheerful than he has been since admission, pulse 120; no exudation can now be seen, but wherever it has existed the surface is raw and irritable; the voice is slightly nasal in tone; tongue clean and moist. From this time the child progressed favourably making a slow but perfect recovery

I am indebted to Mr. J. A. B. Thompson for the following short notes of some cases which occurred in his practice, near Newcastle-on-Tyne, where diphtheria and scarlatina

seem to have been combined, not only in the same family but in the same person.

J. S. the eldest of a family of six whose respective ages were 2, 4, 7, 9, 12 & 14 years, was attacked by fever, swelling of the sub-maxillary glands and tonsils, and difficulty of swallowing. When first seen there were white patches on both tonsils. This patient had no rash, but all the younger members had a characteristic scarlatina rash. All had fever, swelling of the sub-maxillary glands and exudation on the tonsils; but only one had much difficulty of breathing. All recovered under treatment by the tincture of the perchloride of iron and chlorate of potash internally, throughout the course of the disease. But later on one died from dropsy and kidney affection

Jany 26th 1679. J.H. aged 13, ill two days. scarlatina rash, swelling of sub-maxillary glands, white membranous exudation on the tonsils, difficulty of breathing and of swallowing.

Jany 27th Foetor of breath, no abatement of symptoms.

temperature high, Pulse 120

Jany 28th Slight improvement in breathing.

" 29th Temperature down. From this time the patient gradually improved

Jany 30th Another member of the family similarly affected but without factor of the breath—recovery.

Aug. 10th 1878. J. R. aged 12. when first seen this patient had enlarged and inflamed tonsils, difficulty of swallowing and all the symptoms of sore-throat. There was considerable enlargement of the sub-maxillary glands, with loss of appetite, high fever &c.

Aug 11th Signs of diphtheria—white exudation on both tonsils, purulent discharge from the nose, breath very offensive in odour, difficulty of breathing and a constant tendency to cough. Left breast enlarged to the size of a goose's egg, and is slightly tender but not red.

Difficulty of breathing gradually increased, the nasal passages becoming completely covered up, and patient died from asphyxia in the same evening—the fourth day of the disease.

Dec 14th 1878. T.R. aged 8. well marked scarlatina rash, which appeared on the second day on the legs, arms and neck. When first seen the sub-maxillary glands were swollen and there was a white exudation on the tonsils. He gradually sank from the time he was first seen and died apparently from asthenia, there being not much laryngeal obstruction at any time in the course of the disease

The above cases will afford examples of the greater number of the more important phenomena of diphtheria in its ordinary forms, as seen in this country.

We shall now glance briefly at the individual symptoms.

Temperature in diphtheria cannot be regarded as a characteristic feature of the disease. It usually rises rapidly during the first day or two until it reaches 102-104° F. at the time when the membranous exudation begins to appear. With the appearance of the exudation the temperature generally falls somewhat suddenly to the

normal standard — or even lower if there be much prostration — at which it may remain during the remainder of the disease; or there may be slight exacerbations with the appearance of fresh patches of exudation. The highest temperature I have seen in diphtheria was 104°F. once that I have only met seen, after tracheotomy (Case I). In case II the temperature never exceeded the normal. In case III it was below the normal until the period of reaction set in after the operation when it got up to 103°. Trousseau says: "At the invasion of the disease the fever is pretty high, but after the second day it begins to subside, and by the third or fourth day has quite disappeared." Bristowe says that in cases where the larynx and trachea are implicated "the temperature may rise in the course of the disease to 106° or 107°!" It is highly probable that with such a temperature pneumonia or other lung complications may be present.

Albuminuria is frequently present. The occurrence of albumen in the urine of diphtheritic patients was first observed in 1857, by Dr. Wade

of Birmingham who, by finding certain changes in the kidneys of patients who had died of diphtheria, was induced to make a careful examination of the urine during life. Since that time it has been found by all observers who have taken the trouble to examine the urine of diphtheritic patients, that in a certain proportion of cases albumen is present. The proportion of cases in which it is found varies very much, — one observer saying that it is present in a third, another in a half, whilst a third declares that it is present in two-thirds of all the cases occurring in his practice. For my own part I have failed to detect it in more than from ~~from~~ 15 to 20 per cent of all the cases I have seen. It is no indication of the severity of the case, for it may be absent in the worst cases, and present in the mildest. The quantity may vary from the slightest trace to a quantity which renders the urine almost solid when heated (Case XI, v. 13.)

It would appear that albuminuria in diphtheria is an early phenomenon of the disease

and that it is a transient one, seldom producing serious kidney lesions or ending in anasarca. In these respects diphtheria differs essentially from Scarlatina in which albuminuria occurs late in the disease, causes serious kidney lesions, and almost invariably ends in anasarca;

Enlargement of glands is, next to the exudation in the throat, one of the most constant and perhaps the most important diagnostic symptom. The glands apt to be affected are the Parotid, sub-maxillary, the lymphatics about the angles of the jaw and in the sub-maxillary region. Trousseau says: "Generally from the very beginning of the attack, the lymphatic glands at the angle of the jaw, those therefore, which correspond to the first affected tonsil, are turgid. This is an almost invariable phenomenon, or at least, it is not wanting once in ten times" If we look back to the cases recorded, we find with very few exceptions that glandular enlargement was less or more

present in almost every case. For anatomical reasons the glands above mentioned may escape when the disease is confined to the larynx or trachea

The exudation is seldom wanting, though it is sometimes small in quantity and of short duration. It is not uncommon to see cases of diphtheria without any visible exudation, but this is no proof that the exudation does not exist, for it may be in the trachea, larynx or nasal cavity, as indicated by croupy symptoms or coryza, though we cannot see it in these parts.
Morell Mackenzie says it may be absent in two classes of cases viz, "Those in which death from blood-poisoning occurs before the exudation has time to form, and those in which the local process is not severe enough to result in the formation of a definite membrane."
The situation, extent, and appearance of the exudation vary very much. Its favourite

seat is the tonsils, pharynx, larynx or velum palati; but it is often found in the trachea, bronchi or nasal cavity; it may also extend down the oesophagus even to the stomach; it is frequently found inside the cheeks and on the gums. Trousseau relates the case of a child at the breast, where the exudation first appeared at the commissure of the lips, and afterwards a false membrane formed on the mother's breast. From the nasal cavity the disease may extend along the nasal duct to the eye, where false membrane may form on the conjunctiva. Open wounds or abraded surfaces of any part of the body are liable to be covered by false membrane; and during epidemics it is not unfrequently seen about the orifices of the genito-urinary organs and of the anus.

The exudation may be simply a few specks on the palate, tonsils or pharynx; or it may be so extensive as to form a complete cast of these parts, together with the larynx trachea, bronchi, and nasal cavities.

In colour it may be white or grey, yellowish or dark. The colour — roughly speaking — gives a tolerably fair idea of the severity of the disease; the white, as a general rule, indicating a mild, while the yellowish or dark exudation bespeaks a more severe type of the disease.

Paralytic affections frequently follow diphtheria, they are met with in nearly ten per cent. It would appear that mild cases are almost as liable to be followed by paralysis as severe ones, and indeed it often happens, when the case is a very mild one, that we are unable to discover its true nature until the occurrence of paralysis takes place. Paralysis may come on during the course of the disease, during convalescence, or at the end of some weeks when the patient is apparently well and following his daily avocations.
The velum palati is usually the first part to be affected, giving to the voice a nasal tone, and when the patient tries to swallow

fluid, part of it escapes through the nose. When the patient opens his mouth we see the velum and uvula hang down and the power of voluntary motion is in part or entirely lost. Sensation is either lost or greatly impaired. Paralysis may esetend to the larynx and pharynx, giving rise to loss of voice and difficulty of swallowing. The epiglottis having lost its sensibility may permit of the passage of food into the air passage, and in this way sudden death may result from asphyxia.

Ocular Paralyses are of frequent occurrence during recovery from diphtheria. They generally begin by causing dimness of vision - the patient becomes unable to read small print or to thread a fine needle &c.; it is remarkable however that he retains the power of seeing distant objects. As the case goes on we generally get squinting, double vision &c. making their appearance.

The esctremities are often involved and the legs more frequently than the arms. The muscles of respiration, the heart, the bowels, and the sphincters of the rectum and bladder may all

be involved.

As a rule the paralyses in diphtheria are of a temporary kind; they seldom involve several groups of muscles or several organs at the same time, but shift about from one set of muscles or one organ to another, and after remaining for a variable time – usually some weeks – generally terminate in restored function of the affected part or parts.

Such a favourable termination is not always seen however, for, sudden death resulting from paralysis is one of the peculiarities of the disease, whether the affected part be the heart, the muscles of respiration or deglutition or the bowels.

When giving a short account of some cases illustrative of the more important phenomena of diphtheria, as at present known to us, I purposely gave a good many of the mild type, for I think cases of this type are productive of a great deal of evil in as much as they too often either escape notice altogether

or run their course as catarrhal sore-throat or tonsillitis. I have of late been very much impressed by the fact that our standard text-books on the Practice of Physic give very little attention to this type of the disease; they either pass over such cases without notice, or make mention of them in such a way that they are apt to convey to the inattentive the idea that they are of little importance and therefore not worth looking after. Doubtless these mild cases are in themselves of little importance, for the patients as a rule make a rapid and perfect recovery: but considered in relation to others they are of the very utmost importance and demand the closest attention from every medical man. If called to see a case where there have been premonitory symptoms, where the tonsils are enlarged and covered with a yellowish, firmly adherent false membrane, where there is coryza, nasal voice and fetor of the breath; we have no difficulty in at once saying that that child has got diphtheria. But the case is very different if a good many of these symptoms are wanting and

if those present are only imperfectly marked, especially if no case or cases of diphtheria are, or have been known to exist in the neighbourhood, neither at this time nor for several months - perhaps years - previously. The latter may be as genuine a case of diphtheria as the former, the difference being merely one of degree and not of kind. A case of well marked diphtheria will, as far as possible be avoided by every one, and the risk of its being communicated to others rests very much with the nurses and attendants of the patient; but slight cases, not being suspected of being diphtheritic, are avoided by no one, and therefore it comes to be a very important matter to form a correct opinion of the true character of the disease. A child becomes slightly unwell, it is perhaps slightly feverish, fretful and restless; the doctor is called in and he either has not the time to spare, or he does not like to put himself to the trouble of making a thorough examination and investigation of the case, but hastily declares it a case of ordinary cold, or perhaps of catarrhal sore-throat. It soon gets

abroad that Mrs so and so's baby is unwell and that the doctor has been to see it. Next day perhaps half a dozen ladies will be to see baby and hearing that it is only suffering from an ordinary cold, each must of necessity "give baby a kiss to make him well" Their example is followed by their children, who frequently accompany their mothers, and too often by the brothers and sisters of baby also. These are the cases — wolves in sheep's clothing — which spread the disease.

The following case recorded by Greenhow (Greenhow on Diphtheria p. 146) is a good example of the disease being spread by a mild case.

"In Dec. 1856 a boy returned to London from school in Sussex. Sore-throat had been prevailing in the school and diphtheria in the neighbourhood. He felt unwell on the very home and was taken ill with sore-throat soon after his arrival. A nursery-maid aet 17 attended him during his illness, and on the third or fourth day after his return, was also seized with sore-throat and sent home to her friends.

At this time sore-throat was not prevailing in the neighbourhood of the girl's residence, neither did it make its appearance in an epidemic form in the parish in which she lived until after the lapse of several months. A day or two afterwards, the father, mother, and I am told some other members of the boy's family likewise took sore-throat. The girl became a dispensary patient under my care and recovered in the course of ten days; her ailment having been simply inflammatory angina with swelling of the tonsils without diphtheritic exudation. Two or three days after the nursery-maid's return to her parent's home, a younger sister also fell ill with the same kind of inflammatory sore-throat, and, eventually, within the space of three weeks, nine persons residing in the house, who had been in communication with the nursery-maid, but were not all members of her family, suffered in succession from the same disease. The ninth case exhibited a small patch of firm, white, pulse membrane on either tonsil, the patch on the left tonsil being

about as large as a horse-bean; that on the right bigger than a small pea. The cases all recovered, and except the least, did not present the proper diphtheritic character."

"These cases" he says, "would appear to show that the mild kinds of sore throat unaccompanied by exudation, which prevailed so commonly during the epidemic period, were likewise contagious."

Or again, take the following very striking examples of similar cases from Dr. James Begbie's "Contributions to Practical Medicine"

Miss A. aet 15, the eldest of a family of ten children, residing near Leith, showed well marked symptoms of diphtheria on 1st Mar. 1861. A brother aet 10, sickened at an early period of his sister's illness, and on Mar. 4th presented well marked features of the disease. At an early stage of their illness their medical attendant had recommended the removal of the younger members of the family from home. They had been strictly kept apart from the sick from the commencement of the illness and were now

sent in two parties - one of two and the other of six - the former to friends in the immediate neighbourhood, the latter to Musselburgh, a distance of six miles. They were both considered to have remained unaffected by the disease.

The larger party, after a residence of fourteen days at Musselburgh, were permitted to visit some relatives in the neighbourhood of Stirling. On the sixth day after their arrival, the youngest child of the family resident there, sickened of the disease, and in succession two others - the second fourteen days after the first, and the third fourteen days after the second.

On March 25th 1861, just three weeks after he had been called to see Miss A. Dr. Begbie tells us that he was called to see a little girl aet 4, living in the immediate vicinity of the residence of Miss A. and maintaining with her family a friendly intercourse. This child he found suffering from paralysis which he regarded as diphtheritic. She sickened a short time before Miss A. was seized with diphtheria. The attack seems to have been a mild one and as no

pellicular exudation was observed in the mouth the disease ran its course under the name of gastric fever. Dr. Begbie regards this as a case of genuine diphtheria from which Miss A. contracted the disease.

But he was still at a loss to account for the infection of the family near Stirling by means of the children from Musselburgh. At first sight the contagion was supposed to have been conveyed by clothing, carried directly from the house in the vicinity of Leith, where the disease first appeared, to the residence of the family in Stirlingshire. But on closer investigation it was found that one of the children who went to Musselburgh, was observed to be dull and dispirited before leaving his father's house; this one ailed while at Musselburgh, and before leaving there for Stirlingshire early symptoms of paralysis were beginning to appear in feeble and unsteady walking. These symptoms increased while in Stirlingshire and when he returned home he was paraplegic. This

Dr. Begbie regards as the connecting link between the family in the vicinity of Leith and the family in Stirlingshire

Now, I think such cases as these should serve to impress upon us fully the great necessity of looking after mild cases with a view to prevent a spread of the disease. — Prevention is better than cure; great events have often very small beginnings; a small spark may light a great fire. So it is here, we have cases of diphtheria so mild in type that they would have passed unobserved, but for their sequelae, giving rise to wide-spread and fatal epidemics. Professor Uertel, writing with regard to the outbreak of diphtheria in the Grand Ducal Family of Hesse-Darmstadt, and after having searched in vain, in every possible direction for the source of the infection, says: "Princess Victoria must either have been infected by some person who was in intercourse with her - and this supposition does not seem to be quite unfounded - or she acquired the disease in the town, in which diphtheria is everywhere propagated. Here

especially those slight cases which I have described as "Catarrhal" are of importance. The patient might move about while thus affected, as with an ambulant typhoid; and the affection might be cured spontaneously without any medical interference. Nevertheless, such a slight affection may convey the germs for the development of the worst Croupous forms of diphtheria, if there be a peculiar disposition to such. I have observed this fact repeatedly in the last fifteen years during which I have studied the disease; and I should like to draw once more, very urgently, the attention of the profession to this subject."

Here again we have an example of the disease, not in a mild form, but as Oertel says "in the worst form it could take" being communicated, in all probability, by one of these mild cases - so mild indeed as to escape all notice though it was carefully searched after.

I would therefore insist with all my might upon the great importance of every medical practitioner keeping himself thoroughly alive to the occurrence of these cases of a mild type, with a view to

prevent a spread of the disease. It is often very difficult to detect such cases at their commencement, but if there be the slightest reason for suspecting the case to be diphtheritic in character, we should treat it as such and ~~con~~ wait, carefully watching the subsequent course of the case. This can easily be done without causing unnecessary alarm and it may be the means of preventing a spread of the disease.

Death from diphtheria occurs in various ways; but extreme suddenness of death when the patient is apparently out of danger, is a marked peculiarity of the disease.

In the gangrenous form the blood vessels may be eaten into and death result from haemorrhage. Or septic matter may enter the circulation and after death secondary abscess may be found in the lungs, liver, and other parts.

The patient may receive such an enormous dose of the poison that he is at once laid prostrate and never rallies.

Death may be the result of exhaustion and want of

nutrition. The stomach remains irritable and rejects everything taken into it. and the patient is utterly unable to take nourishment of any kind, by and by the thread of life becomes worn out and he dies.

In a very large number of cases death is the result of asphyxia, from laryngeal and tracheal affection

But death may be the result of nervous disorder supervening in the form of paralyses. This form of death, which is not uncommon, frequently occurs very suddenly, and often at a time when it is not at all expected- perhaps when the patient has been convalescent for several days or weeks, or even after he has resumed active employment. The cases recorded in these pages afford only two examples of the modes of death, but these were both sudden. Thus in case iii the patient was dying of asphyxia, but this cause being obviated by tracheotomy, and the patient progressing favourably for a time, he was all of a sudden taken ill and died immediately, apparently from asthenia.

Then in Case X we have a good example of very

sudden death during convalescence, apparently from a degree of paralysis, especially affecting the bowels and the heart. For examples of a similar kind we have only to look into any work on the subject and we find it teeming with illustrations of sudden and unexpected death at a time when the patients might have been said to be out of danger.

These sudden and peculiar modes of death render it necessary for us to give a very guarded prognosis in diphtheria. In fact we are not justified, nor are we safe, in hastily pronouncing a favourable prognosis, even in the mildest cases.

The Treatment is <u>general</u> or <u>constitutional</u>, and <u>local</u>.

In carrying out the general treatment the indications are clearly those of nourishment and support. The disease is one of exhaustion and therefore, we must carefully avoid, depletory, reducing, or depressing agents; and direct our treatment to the maintenance of the bodily powers.

General blood-letting, leeching, blistering and Cupping used to be favourite modes of treatment, but these in time, not only proving useless but decidedly injurious, soon fell out of use. At one time mercurials were thought to be the proper treatment for diphtheria, but these too have fallen into disuse. In the same way various other remedies - sulphicle of potassium, bromine, balsams of Copaiba and Cubebs &c. - have been strongly recommended at different times, but with equally unsatisfactory results.

Emetics were formerly, and are by some still much given when there is obstruction of the larynx or trachea. No doubt the act of vomiting assists mechanically in dislodging and in promoting the expulsion of false membrane from the larynx and trachea; but emetics if not judiciously employed may do great mischief. The act of vomiting requires considerable muscular effort, and therefore expenditure of strength, the avoidance of which may be of the greatest importance to a person already reduced to the verge of dissolution. When

owing to the great tendency there is to failure of the heart's action and syncope, emetics which act as cardiac sedatives are specially contra-indicated. The most frequent emetic of this class is tartar emetic.

Emesis then, I believe, should seldom be produced except under certain circumstances in healthy children, and when it is had recourse to some agent which acts as a cardiac stimulant, such as mustard or carbonate of ammonia, should be used; and not a cardiac depressor like antimony.

It is generally necessary to give alcoholic stimulants pretty freely, in small quantities frequently repeated, throughout the course of the disease. These are perhaps best given in the form of wine or brandy. If we give wine — especially to children — we should make sure that it is the best quality, as bad wine is very apt to cause or increase irritation of the stomach. Brandy possesses one great advantage, and that is, that it combines beautifully with milk which forms such an important part of the

nourishment of such patients.

In the form of drugs for internal administration, the Tincture of the Perchloride of Iron, and Chlorate of Potash, are now the popular and almost universal remedies. They are generally given in combination, and both are believed to act topically, if they come into contact with the affected part, in the way of destroying and preventing the spread of the false membrane; while at the same time the iron acts as a tonic and blood restorer.

But by far the most important part of the treatment consists in careful nursing, with careful and systematic feeding.

The patient should, if possible, be placed in a large, cheerful, well ventilated room where a constant temperature is maintained. The action of the skin should be promoted by clothing in flannel &c. A nurse should remain by the bedside of the patient night and day. If the patient be very weak he should not be allowed to talk much, nor to sit up in bed - not even to take his food - so that there may

be the least possible waste of strength. This is a point of great importance where there is a tendency to syncope or failure of the heart's action, for we often see patients after an effort to sit up, it may be to use the bed-pan or to take food, suddenly fall back and expire instantly.

The food should be nourishing, easily digested and assimilated, and in as concentrated a form as possible. It should be given in small quantities, frequently repeated in systematic order. It will consist chiefly of milk — with lime water added if necessary - beef tea, wine, brandy, brandy and egg &c If there be inability to swallow the oesophageal tube may require to be used. If great restlessness, want of sleep or any other complication should arise we must combat it as best we can according to the circumstances of the case.

During convalescence a tonic treatment must be pursued — especially iron, or if paralysis, nux vomica will be found very useful.

Local Treatment. Various agents have at different times been applied to the local lesion and to the throat. The local applications which are still used are included in the following way, Caustics, as nitrate of silver, strong acids &c. Astringents, as tannic acid, alum &c, Solvents, as lime water, chlorate of potash &c, and Antiseptics, as Carbolic acid, permanganate of Potash &c.

Local applications are made with a view—

(1) Of relieving pain and suffering

(2) Of destroying the parasite and so prevent the membrane spreading

(3) Of separating or promoting the separation of the false membrane

(4) Of their acting as antiseptics and disinfectants

The practice of applying caustics and astringents to the throat has now fallen very much into disuse. But solvents and antiseptics are still much used.

Solvents may conveniently be applied in the form of a medicated spray, as the sulphurous acid spray, which is at the same time an

antiseptic. Carbolic acid can conveniently be applied as the glycerinum acidi carbolici, permanganate of Potash as Condy's fluid. For the application of these we have only to attach firmly, to the end of a long pen-holder, or some such stick, a small sponge or piece of soft cloth (lint) and the apparatus is in readiness. It is important that the throat should be frequently swabbed with this application if there be foetor of the breath, and the nurse should be strictly charged to be very careful to clean away the viscid mucus and detached portions of false membrane that may happen to lodge about the back of the tongue or fauces.

The local application of the flowers of sulphur is now a favourite remedy with many. My governor - Dr. Goldsmith - who has seen and treated a great deal of the disease, speaks very favourably of the local application of sulphur, and he uses it in almost every case. He applies the dry powdered sulphur to the affected part, and at the same time gives a combination of the

tincture of steel and chlorate of potash internally. Under this treatment he has been very fortunate with his cases; I have seen him 'pull through' cases which were apparently hopeless.

If it be true that the local lesion is the stronghold of the parasite, and if sulphur destroys the parasite, as it is believed to do, then it is easy to see how the local application of sulphur may be of value

When diphtheria breaks out in a family the patient or patients should at once be completely separated from all the other members of the family, only the nurses and those necessary to look after the patients comforts being allowed to enter the sick room. If there be more children in the family than those affected they should, if possible, be sent from home for a time; if they remain at home they should not be allowed to attend school or to associate with other children, for several weeks after the disease has disappeared. If the disease be at all prevalent or in anything like an epi-

demic form, schools should be closed.
Mild cases we should treat in exactly the same way. If called to see a child who had sickened a day or two previously, and if there be the slightest reason for suspecting his illness to be of a diphtheritic character, we should always treat it as such and carefully watch its progress; even though we be mistaken in our opinion. Better to err on the safe side than to run the risk of spreading the disease.
If in a few days after our first visit we are able to say to the parents that their child has not got diphtheria, they will be delighted to hear it; but if we are under the painful necessity of saying to them that it has, then they are saved from a sudden shock, as their minds are already prepared to receive such information; and it may be that a spread of the disease has been prevented.
Disinfectants should be used in the patient's bedroom throughout the course of the disease.
All his discharges and all clothing used in connection with him should be disinfected.

After recovery the bedroom should be well fumigated with sulphur, and the doors and windows kept open for several days and nights, so that a current of fresh air may pass freely through it for some time before it is re-occupied by another person.

Tracheotomy.

Supposing we have given our patient careful feeding and attentive nursing, and that we have administered and applied constitutional and local remedies to the best of our abilities; I say supposing we have done all these and many other things which we may have thought necessary, and that our patient instead of improving, gets worse and life is now threatened from asphyxia: then there is only one resource for us, and that is to open the windpipe.

This operation is called for when the patient is in danger of being asphyxiated.

Sir Thomas Watson says: "If you do not see your patient until his powers are nearly exhausted, do not abstain from the operation even

though you may feel convinced that it will be unsuccessful; for if it do not save life, it will disarm death of its agony."

Erichen, in his Science and Art of Surgery, speaking of diphtheria says: "No patient should ever be allowed to die from simple laryngeal obstruction, whether that be spasmodic or dependent on organic disease, without an attempt being made to save life by opening the windpipe. It is as unpermissible for a Surgeon to allow a patient to die of laryngeal asphyxia, without an attempt at relief by opening the windpipe, even though life appear extinct, as it would be to let him die of haemorrhage without attempting to ~~Constrict~~ Contract the bleeding vessels"

Trousseau says: "Whatever be the age of your patients You ought always to give them the chance of being saved by tracheotomy, when there is no special or absolute contra-indication"

Tracheotomy, like herniotomy, is not in itself a serious or dangerous operation. It is true that nearly three-fourths of all the diphtheritic patients

operated on in this way die, just as a very large proportion of patients operated on for strangulated hernia die; but in neither case is death the result of the operation, but of delay, together with certain complications that may arise.

It is true of a great many Surgical operations that success depends, not so much on the actual performance of the operation, as on the after-treatment of the case; but in no other case is this great truth so eminently exemplified as in tracheotomy. I have no hesitation at all in saying, from information I have collected on the subject, (whether that information be derived from what I have seen, read of, or heard from the lips of others) that a large proportion of tracheotomy cases are lost simply from inattention to the details of after-treatment.

But it is not at all surprising that general practitioners, who have very probably never either seen the operation performed or the after-treatment carried out, until they are themselves called upon to operate and treat the case, should lose cases through neglect to details. I have said that

probably they have never seen a case treated after the operation; but I may say almost with certainty that they have never read a detailed account of the after-treatment - not in our standard, English, Surgical text-books else they have been more fortunate than I have. We do get in almost any work on Surgery that we take up a full and detailed account of operation until the tube is introduced into the windpipe; but here the account of the treatment stops abruptly, leaving the young and inexperienced Surgeon, it may be, either to do likewise - which unfortunately he too often does - or to make further discoveries for himself. Well do I remember the first time I was called upon to perform the Operation! With the operation itself I had no difficulty, although performed under rather unfavourable circumstances — being called upon to operate at once, by gas light, on a short fat necked child 20 months of age. But in vain did I search through all the Surgical works, ancient and modern, that I could lay my hands upon, for an account

of the management of the case after operation.

This then, I hope will be a sufficient apology for my treating this part of the subject in detail.

The operation is called for in every case where life is threatened from laryngeal or tracheal obstruction, and it is of the utmost importance that the operation should be undertaken early – not waiting until exhaustion, or poisoning of the system by venous blood, or lung complication, or it may be a combination of all these, has rendered the chance of recovery almost hopeless.

Let us suppose that the operation has been decided upon and that we are at once to proceed to its performance.

If possible we should see that the bed is quite ready, in which the patient is to be placed after the operation, and that the steam-generating apparatus is set to work, before commencing the operation. If the patient be a dirty unwashed child as is frequently met with in large towns it will add considerably to the comfort of the Surgeon, and afterwards to that of the patient,

to let it, if possible, have a warm bath.
Then we should see that all our instruments are in readiness. These are few in number and for all practical purposes may be enumerated as follows viz.,— A good scalpel; dissecting forceps; artery forceps; a sharp hook; a director; an instrument for separating the lips of the tracheal wound while the tube is being introduced; ligature; retractors; scissors and tracheotomy tube. We should also see that a sufficient supply of proper sponges, towels &c is at hand. The child, unless already unconscious, should be put under the influence of chloroform; and we should avail ourselves of the best light that can be afforded us.
Having then obtained the services of two or three assistants, if possible, the child now under chloroform should be placed straight on its back, with a pillow under the shoulders, allowing the head to fall a little back so as to put the tissues on the front of the neck well upon the stretch. The head being now held perfectly straight and steady

the operator should clearly make out the land-marks which are to be his guide – the symphysis of the lower jaw, the pomum Adami and the episternal notch all in the same straight line, should especially be observed. Standing on the right of his patient the operator should enter his knife straight in the middle line over the cricoid cartilage, and cut straight downwards until his incision is two and a half or three inches long. If any large congested veins come in the way at this or any other stage of the operation, they should, as far as practicable, be hooked aside and not cut. The next stage of the operation consists in carefully dissecting down through the soft parts and holding them aside by retractors until the rings of the trachea are exposed. To make sure that the trachea is fully exposed the operator should not only feel the rings with the finger but he should see them shining white at the bottom of the wound. If there be any arterial bleeding the vessels should be lig-

atured or secured in some other way as soon as they begin to spout; if the bleeding be only venous - of which there is likely to be a considerable quantity - the best remedy is the opening of the trachea and the re-establishment of free respiration, when venous congestion is at once relieved and haemorrhage ceases. The trachea being thoroughly exposed a sharp hook is now to be introduced into its upper part so as to draw it upwards and forwards and to prevent it moving. The soft parts being now held aside by retractors, the trachea being steadied and drawn forwards by the sharp hook, and all blood being very carefully sponged out of the wound - just immediately before opening the trachea -; the point of the knife should be introduced sharply and carried downwards so as to divide three or four of the uppermost rings of the trachea. Some instrument is now introduced to keep the lips of the tracheal wound apart and between the limbs of this instrument a bivalve canula, the sides of which being pressed

together during introduction, is introduced into the trachea, and retained in position by tapes which fasten behind the neck. The inner tube can then be introduced at pleasure. When the trachea is opened air rushes in, a hissing noise is made, and the child has usually a violent paroxysm of coughing, during which a quantity of viscid mucus and any blood that may have passed into the windpipe, and often pieces of false membrane, are brought up. The tube having been fixed in position, and respiration through it being fairly established, a few folds of gauze, a piece of lint, or a sponge moistened in hot water, should at once be placed over the orifice of the tube and the child conveyed to his cot where the steam-producing apparatus is at work. If any detached portions of false membrane are seen in the trachea they should be carefully removed before the tube is introduced.

It is of the utmost importance that plenty of time be taken to the operation. Tracheotomy

who, I believe, performed the operation some hundreds of times says: "Operate slowly, very slowly. I lay great stress upon the absolute necessity of proceeding very slowly. I have never seen an accident arise from too much slowness; but I have often witnessed the difficulties and dangers of too nimble tracheotomy, even when performed by an able operator."

"Hence it is, therefore, that I denounce with all my strength the expeditious mode of operating" . . . . . .

I think the best place for opening the trachea in children is just below the cricoid cartilage; and the opening should be a free one, as also the incision in the soft parts. By so doing we are saved a great deal of trouble and loss of time, and that without increased risk to the patient.

It is often stated in books that we should avoid cutting the isthmus of the thyroid gland else we may have troublesome haemorrhage. To this I have only to say that in the few

cases I have operated upon, I have always cut it through without the least hesitation and have never had the least trouble with haemorrhage. In one case only a small artery spouted when the isthmus was cut, but this was easily commanded by a ligature - the only ligature used in the three cases. Various instruments have been devised and used for separating the lips of the tracheal wound until the tube has been introduced. I used a split-hook, and I found it to answer the purpose admirably. Being of small size it is very easy to introduce through the narrow opening in the trachea, while the legs are close together; once introduced, the key which holds the legs together has only to be drawn up towards the handle of the hook, and the legs separate and remain apart, leaving plenty of space between them for the introduction of the cannula. The legs being small and the back of the hook looking forwards (upwards) there is not the slightest difficulty in withdrawing it

after the tube has been introduced. While introducing the tube one possible source of error requires to be kept in mind, and that is, that the tube instead of entering the trachea, as is supposed, may pass down in front of it, beneath the soft tissues, and between the sterno-thyroid muscles. This so often happens that we require to be constantly on our guard against it. The hook should not be withdrawn until we are satisfied that the tube is in the trachea.

The tube used should be the largest possible consistent with the size of the trachea opened. If we use a tube of narrow calibre it is constantly getting blocked up with mucus &c; and even though we keep it perfectly free from all such obstructing agents, respiration is never free and and is only carried on at the expense of considerable effort, which expenditure can as a rule be ill afforded by such patients. The tube should be a curved silver one and should consist of two parts, an outer bivalve canula and an inner tube. The canula should be so made that the valves can be approximated

during introduction and so facilitate that part of the operation. The canula should have a neck-plate, which should be freely moveable upon it, and having arrangements for the attachment of tapes, which should be fastened at the back of the neck, to keep the tube in position. The neck-plate should also carry an arrangement for retaining the inner tube in position after it has been introduced. It is of importance that this arrangement be of a simple kind and easily undone, as the manipulation necessary to adjust or undo an elaborate or difficult one is very unpleasant to the patient. Then again, we are often called upon to remove the inner tube in a great hurry and if this be a difficult matter requiring some time our patient may be dead before we can afford him relief. The canula should be freely moveable on the neck-plate in order that it may also freely move with the trachea. If we use a rigid tube it will be apt to irritate the trachea and that may be to such an extent as to

result in abscess and its consequences.
The inner tube should always be a little longer than the cannula, so as to project beyond it in the trachea. If both were of the same length, or still more, if the cannula were the longer, then in the withdrawal of the inner tube a plug of mucus might be left blocking up the cannula, and we have no means of displacing this unless we withdraw the cannula — indeed we may not suspect its presence and thus it may be left as an embarrassment to the breathing. All this is avoided by having the inner tube a little the longer.
The patient should, if possible, be treated in a room the temperature of which can easily be kept up; the room should be cheerful and well ventilated.
The patients bed or Cot should be completely closed in on all sides and over the top, except the side next the fire which must of necessity be kept open for the nurse to attend to the patient and for the entrance of the steam pipe. The object of the steam is to keep the patient

breathing a moist heated atmosphere. When inhaled in the natural way, the air while passing through the nose and the mouth gets heated up and therefore cold air is never allowed to come into contact with the delicate mucous membrane of the lungs. But when a person breaths through an artificial opening in the trachea, cold air at once passes into the lungs and irritating the mucous membrane may cause pneumonia. To obviate this we prepare an artificial atmosphere by keeping the patient in a warm place and passing steam about him.

To surround the Cot and cover it in I have found that a set of ordinary ward screens with a double blanket closely tucked over the top, answers the purpose very well.

The apparatus for supplying the steam is a most important part of our means of treatment. It should be of such a kind as to keep up a full supply without intermission. This is a point that is very often neglected, sometimes through deficiency of

the apparatus, and sometimes through inattention of the nurse or person in charge. I presume most people are aware that an ordinary kettle with a small pipe fastened to its spout, is the apparatus generally used for generating the steam and for carrying it to the Cot. Now, it seems almost unnecessary for me to say that it is impossible with such an arrangement to keep up a constant, much less a necessary supply of steam. The kettle is small and the full of it of water is soon exhausted, consequently, while the water supply is being renewed and until it is got up to the boiling point, the patient is without steam. Or the apparatus gets disarranged, or the fire gets down, or something else happens to cut off the steam. The result of all this is, that in all probability, the patient is fully half time without steam. Such is not the way to keep our patient in a warm and moist atmosphere, and to prevent him breathing cold air.

To ensure a constant and full supply of

steam we must have a proper fireplace, a proper boiler, and a proper pipe for carrying the steam to the Cot.

The fireplace should be large and roomy, and the grate should be of such dimension, that the part left unoccupied by the boiler is quite sufficient to allow of renewals being made to the fire in such quantities, as to keep the water in the boiler always at the boiling point. If the grate be so small that the boiler or kettle completely covers it and consequently must be lifted off while the fire is being renewed, then there is a time — until the fire lights up again — that there is no steam.

The boiler should be a largish one — holding at least as much as three or four ordinary large kettles — and should be constructed in such a way that water can be added without interrupting the steam supply.

If we are not fortunate enough to procure a boiler which heats the water up to the boiling point before it enters the chamber

from which the steam is given out; then we should make sure that no water is poured into the boiler which is not at the boiling point i.e. add boiling water only.

The pipe or tube for carrying the steam to the Cot should be joined to the boiler by means of a screw, which although secure yet can be easily undone. If we trust to insecure or temporary fixtures they are constantly getting out of order. It does not do to have a small pipe, it should be of such a calibre as to give a good jet of steam. If any coils or sudden bends in the pipe we must constantly be on our guard that water does not collect in these parts and so cut off the steam; I have frequently found this to be the case. For this reason one end of the pipe should be a little higher than the other in order that any water which may happen to collect in it, may either flow back into the boiler or out at the extremity of the pipe. If there be nothing in the relative heights

of the boiler and cut to contra-indicate it, the esctremity of the tube nearest the cut should be a little the higher.

Some allow the jet of steam to escape over the bed and immediately over the patient. I have found this an inconvenient place for it, as the child is apt to burn its hands on the hot pipe, or to get scalded by the steam; then the pipe is in the way of the nurse and consequently the boiler is constantly in danger of getting upset. These dangers and risks are avoided by allowing the jet of steam to escape immediately outside the rails at the head of the bed. The pipe can at the same time be fastened to these rails making it and the boiler quite secure. The patient is quite as much - if indeed not more - benefited by the steam in this latter situation as in the former, then it is much more convenient for the attendants and the child is saved the risk of getting burnt.

Having gone aside for a moment, as it were, to glance at the tracheotomy tube, the cot, and the steam-producing apparatus; we shall now return to our patient whom we left in the cot immediately after the operation. We should now secure the services of two intelligent and thoroughly reliable nurses — one for night and the other for day duty — to sit all the time by the bedside and do nothing else but attend to the patient. During the first few days, the patient should never on any account - not even for the shortest space of time - be left without an attendant; for he may suddenly be seized with a fit of coughing, the tube may become completely plugged up and in a few minutes the child dies from asphyxia. But the surgeon who is interested in his case if he hope to be successful, must look strictly after it himself; or where this is impossible - for in many cases it is impossible - he should leave the case under the charge of another member of the profession, who has not only learnt what is necessary to be

done, but who has seen it done, and actually performed it himself before taking full charge. The medical attendant should visit the case frequently, and for the first few days should always be at hand so that he can be had on the shortest notice if an emergency should arise. Such careful attention is absolutely necessary for the first few days and if not prepared to give it the operation might as well not be performed. After the first few days, if the case go on well, it will probably not be necessary for the medical attendant to see the patient more than three or four times a day, to clean the tube and see that every thing is going on right; as an intelligent nurse is generally, by this time, able to give the greater part of the necessary attendance.

The orifice of the tube should be kept carefully covered by a few folds of gauze, a piece of lint or some such material, and the covering should be a good large one so as to go round the child's neck and fasten behind, else the child will constantly

be displacing it; or it will get rolled into a cord, and the tube will be left uncovered. It should be so arranged that it can be lifted from below in the form of a flap, when the tube is to be cleaned or mucus wiped away. This covering not only prevents particles of foreign matter getting into the trachea, but it also serves the important purpose of a respirator.

For a little while after the tube has been introduced the patient is usually seized with violent paroxysmal attacks of coughing probably due in a great measure to the irritation caused by the tube in the trachea during which he often expels through the tube, pieces of false membrane, a large quantity of mucus &c. All this we should be very careful to catch and wipe away as soon as it comes outside the tube, lest it be drawn in again by the next inspiration. For this purpose we should have several small sponges tied on sticks and each as soon as it has been used should be dropped into hot water which should be provided for the purpose and

after remaining sufficiently long to completely soften or dissolve the mucus, should be well washed and kept in readiness for use. The mucus expelled through the tube is very viscid and tenacious, and although it is in a great measure driven out of the tube during a violent expiratory effort, yet it retains some connection with that lining the interior of the tube, and with the next inspiration is drawn in again. In this way the mucus is churned up and down the tube during expiration and inspiration, until at last it gets so dry and tough that it forms a hard coating inside the tube. Layer after layer is in this way added, until at last the tube would ere long become completely occluded if it were not attended to. When the tube becomes narrowed in this way respiration is difficult and performed with considerable effort, and the blood is being imperfectly aërated. All these combine to weaken our patient and therefore should,

as far as possible, be avoided.
It is the duty of the nurse (after she has been shown how to do it, and instructed in the matter) as soon as she sees a paroxysm of coughing coming on, to seize a sponge, lift up the lower border of the covering over the orifice of the tube, and to catch and clear away anything that is expelled through the tube before it is drawn in by the next inspiration. Sometimes it is driven out by the first violent effort at coughing and requires very sharp work to catch it before it is drawn in again; whilst at other times it is difficult to get up and we have to wait for it making its appearance outside. While so waiting the sponge should be held in readiness, close to the surface of the child's neck, just above the orifice of the tube; and as soon as the plug of mucus makes its appearance the sponge should be drawn from above downwards and catch it before it is drawn into the tube again. When the plug of mucus is caught on the sponge it is a good

plan to hold the sponge for a second or two on the orifice of the tube, and rotate it in such a way as to carry the plug of mucus away from the orifice of the tube, when we often find that a great rope of said mucus comes away from the interior of the tube. But though we be ever so careful we cannot in this way succeed in keeping the tube free from obstruction. Hence the necessity for removing and cleaning the inner tube.

Now, it cannot be said how often the tube should be taken out and cleaned; no definite rule can be laid down for this. The rule I have observed is, to remove and clean it when respiration indicates that it is being obstructed, and when breathing can no longer be carried on freely. This may be only two or three times a day, or it may be every hour or perhaps oftener, depending on the circumstances of the case. Before removing the tube we should have a pan of hot water, a stiff bottle-brush and a piece of flexible metal in readiness to

clean the tube. The person who is going to remove the tube should then stand on the right side of the patient, and with the thumb and index finger of the left hand, the palm of which should look towards the patient's neck, he should firmly seize the neck-plate and hold it steady, while he at the same time opposes, by pushing slightly towards the trachea, the effort made by the right-hand which should sharply draw out the inner tube. Of course we should make sure that the key which fastens the inner tube to the cannula is undone before we begin to pull at the tube. The tube being removed should at once be dropped into the pan of hot water and left there for a few minutes in order to soften the mucus which would otherwise be very difficult to remove from its interior. After being a sufficiently long time in the hot water the tube should be taken out and the bottle-brush drawn backwards and forwards through it for several times, when a large quantity of viscid

mucus will usually be removed. The brush must be cleaned and introduced several times. But the brush however well it fill the tube will not remove all the deposit from its interior, and to dislodge this and scrape it out the flexible piece of metal is necessary. The piece of metal should be six or eight inches long, and somewhat about the thickness of an ordinary probe; it should possess a certain amount of flexibility in order that it may follow the curves of the tube, but if it be very flexible it will be too weak and consequently useless for our purpose. If it be cylindrical in shape it should have a flat expanded extremity in order that it may the more easily catch and excise the crust. An ordinary probe with an expanded extremity answers the purpose capitally. If the tube be worn for two or three weeks we require to be on our guard against calcareous deposit which is apt to form a coating on the interior of the tube, and this being difficult to remove

may accumulate in such quantity - especially at the angle of the tube - as greatly to diminish the calibre of the tube.

If the inner tube be very much plugged up then on its removal the patient instead of having a small, suddenly comes to have a large tube to breathe through; and this, together with the fit of coughing generally brought on by removing the tube, causes a large quantity of phlegm and mucus to be expelled just after the removal of the tube. It is therefore very important that one person attend to the patient and wipe away this discharge, while another is engaged cleaning the tube.

The tube, thoroughly cleaned is to be made warm in the hot water or by holding it for a few seconds at the orifice of the steam pipe, and again introduced; the neck-plate being grasped in exactly the same manner as during its withdrawal. A slight attack of coughing usually follows the introduction of the tube, but on its subsidence the patient breathes

freely for a time and enjoys a period of rest and tranquility until the tube again gets diminished in calibre.

The discharge from the wound is apt to cause irritation, excoriation, or even the formation of abscess in the tissues around the wound. To avoid this and to protect the skin from the discharges, it is a good plan to use protective tissue from the very first. A piece of tissue of proper size and shape to sit nicely in the front of the neck should be taken, and a hole made in the centre of it just large enough to admit the canula, which should be introduced through it up to the neck-plate, before it is introduced into the trachea

The child's neck should be kept very clean and dry, by having it regularly washed and all the folds of skin dusted over with dusting powder.

The food of the child should consist largely of fluids - especially milk. But, if there is otherwise in the child's condition nothing

to contra-indicate it, I dont see any reason why it may not also have solid food of a light and easily digested kind; as the presence of a well fitting tube seldom causes difficulty of swallowing, owing to diminished sensibility of the epiglottis and larynx fluid often passes down the windpipe and escapes by the tube

One very important part in the treatment of a child after tracheotomy is, that every one known to it - especially the parents and former nurse - should be strictly prohibited coming into its sight. If they are kept away the child in a very short time becomes attached to its new nurse and remains happy and content with them, But if the friends are allowed to visit it they are apt to slip it in something to eat which is pretty sure to be injurious to it. The greatest objection, however, is that their departure is invariably followed by a severe fit of crying, a violent paroxysm of coughing; and discontentment for the remainder of the day. Such are very injurious to the child and

should by all means be avoided.

The time the tube must be worn varies from a few days to as many weeks. Thus in the cases previously cited, case I wore it 24, and case II 21 days. In case I, attempts were made on the 10th and on the 18th days - the child being under the influence of chloroform - to remove the tube, but croupy symptoms being quite as manifest as before the operation necessitated its re-introduction. In case II the child was put under the influence of chloroform on the 10th day after the operation and an attempt made to remove the tube, but with a result exactly similar to case I.

The child should always be under the influence of an anaesthetic when the tube is being removed; otherwise we will not be in a position to know if the obstruction to the breathing which may then exist be real or only spasmodic. The removal of the tube tickles the trachea; the child gets frightened and bursts into a combined fit of crying and coughing, which passes into violent spas-

modic efforts, which appear to threaten life from suffocation and may last so long as to require the re-introduction of the tube. It may be that after the first spasmodic fit subsides the child could breathe quite well without the tube; yet the fit is so violent that we dare not wait to see. This spasmodic obstruction is avoided by putting the child under chloroform.

The tube being removed, the wound in the neck is not to be closed by sutures, or in any other way, as I at first thought, and as a great many others, far more advanced at that time than I was, likewise thought. The wound is to be covered by a piece of lint moistened ~~in~~ in hot water, and left to fill up or close by granulation which it usually does in two or three days. For a little while at first respiration is carried on partly through the wound, as indicated by noisy breathing when sleeping; but as the wound gradually fills up the larynx becomes more and more active and in a short time the function is carried

is carried on entirely through that channel.

The operation should be performed as early as possible after other remedies seem to fail. But we are not to be deterred from doing it, because we have not seen the patient until apnoea is extreme, and he is apparently on the point of suffocation. Case iii is a very striking example of a patient being rescued from the jaws of death by opening the windpipe; this patient, however, afterwards died, not from apnoea — for the breathing was perfectly free and easy from the time of the operation until death occurred — but from constitutional affection. Sir Thomas Watson, after relating a very similar case which finally recovered, adds: "Now a thousand failures of the operation in saving life, cannot, after seeing this case, prove to me that tracheotomy ought not to be performed when suffocation is imminent from the presence of lymph in the larynx or trachea" (Prin. & Pract. of Physic vol. 1. p 901)

Trousseau with his vast experience on this

subject says: "The operation ought to be performed before death is imminent; but still, let me add, that to whatever degree asphyxia may have proceeded - though the child have only minutes to live - tracheotomy ought to be tried: there is a chance of success, provided the local lesion, the croup, constitutes the chief danger of the disease."

One important question still remains for consideration viz., age.

So much stress is laid upon the age of the patient by some surgeons that, if it does not wholly settle the question, it goes a great way in determining for or against the operation: it being generally understood that tracheotomy in very young children is almost never successful. It is a notorious fact too, that in children under four years of age recovery after tracheotomy is comparatively rare; while under two years it is very rare. Trousseau quoting from Dr. Peter's work says: "Both in boys and in girls, tracheotomy was always unsuccessful when performed

on very young subjects: thus in 56 girls and 51 boys on whom tracheotomy was performed during the year 1858 at the Childrens Hospital, it was performed 15 times on girls between two and three years of age, and 11 times upon boys between the same ages: in these 26 cases it failed. It was only in children above three years that successful cases occurred. Taking as the basis of comparison a very large number of cases of tracheotomy, it was found that the age which gave the larger proportion of recoveries, was five years in boys, and six years in girls."

We have all writers on the subject espressing the same opinion, and Sir J. Watson mentions as one of the great triumphs of Surgery that "Sir Wm Fergusson operated with complete success upon an infant about three years old".

In the British Medical Journal for March 1871, Dr. G. Buchanan has published the results of 39 cases of tracheotomy in children for Croup and diphtheria. Of these 19 were

under 4 years, and of these 19 only two recovered - one being 2½ and the other 2¼ years.
In the same Journal for March 15th 1871.
Mr. Vincent Jackson, Senior Surgeon, South Staffordshire General Hospital, says:-
"It is considered that the operation should not be performed for Croup or diphtheria under four years."
"At the last meeting of the Pathological and Clinical Section of the Birmingham Branch of the British Medical Association Dr. Underhill of the Childrens Hospital, exhibited several tracheae after fatal Croup and diphtheria; and in the discussion which ensued Dr. Russell most distinctly stated that upon clinical grounds, he would not be a party to tracheotomy in Croup-suffering children under four years; and this dictum was assented to by the hospital surgeons present."
Such Quotations as these will enable us to form some idea of the great importance attached to the question of age, by the profession, a

few years ago, and which has - I am sorry to say - got such firm hold on the minds of many of the surgeons of the present day, that it will be, I am afraid, difficult to eradicate.

But as there are exceptions to nearly every rule, so there are to this one - most important exceptions too. The patient under four years who falls a victim to this terrible disease, and who is not benefited by treatment short of operation, is not without a ray of hope. It is fortunate for the community that every one does not take the same view of the matter as did Mr. Jackson and his colleagues.

From time to time we hear of the operation being successful in very young children. Thus, Trousseau had a successful case of 13 months; and one of two years. Dr. Mas-sieurat had one in a child of 13 months, Dr. Bell of Edinburgh had one in a child at the early age of 7 months. Trousseau, after quoting these cases says: "Great clinical importance belongs to these cases; they stand

alone in the records of science, but still they seem to me to justify operative intervention, irrespective of the age of the patient, whenever asphyxia threatens life"

To this small list, where the operation has been successful in very young children, I am happy to be able to add two other cases (Cases I & II) I have no doubt the list might be considerably extended if we could only get an account of the successful operations performed on very young children within the last few years.

I fully endorse the sentiment 'that we should operate when asphyxia threatens life, whatever be the age of our patient' If we have a few successful cases in very young children, I dont see why- if the treatment be properly carried out- there should not be a great many more. The fact of us having these few cases clears away the notion which at one time existed viz., that it was almost an impossibility to have success if we operated on very young children. My

experience has just been the opposite of that of others in this respect. I have performed the operation three times, the younger children recovered, but the eldest - a boy of 6 years - died, It cannot be said that recovery took place because these were favourable cases for operation. Both were undertaken under rather unfavourable circumstances, being operated upon by gaslight. Case I was not only the first tracheotomy I had performed, but the first I had seen; the patient was a strong healthy child with a short deep neck, thus rendering the opening of the trachea more difficult. Case II was a child with a decidedly bad constitution - rickety and presenting all the appearances of a strumous unhealthy child.

I have said that my experience has been the opposite of that of others with regard to age. When I say this I am merely stating a fact which has occurred in my experience, without the slightest intention of indicating that

recovery is more likely to occur in very young, than in children more advanced in years.

The more one sees this subject and the closer he studies it, the more does it force itself upon his mind, that the great mortality in very young children, after tracheotomy, cannot be regarded as independent of the after-treatment.

Suppose we have two children similarly affected, the one two and the other six years of age; and suppose that after the operation we give to the elder child only the minimum of attention which will pull it through: if we give to the younger only the same amount of attention which is given to the elder child, we will, almost for certainty, lose it before many days. The younger and the tenderer the child the more attention must it have if we hope to conduct the case to a successful issue. This is a fact which I am afraid is not sufficiently kept in mind, and the neglect of which assists very materially in swelling the list of deaths after tracheotomy in young children.

I hope the time is not far distant when after-treatment shall be looked upon as the important part of tracheotomy in children, and when its importance shall be fully recognised by every Surgeon. Then, I have no doubt, the operation in the case of young children will be looked to as a means of saving life, and not as the formidable and hopeless operation of the present day.